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ABSTRACT

This Technical Committee Report prepared by industry representatives in Idaho lists the skills currently necessary for an employee in that state to obtain a job in electronic technology, retain a job once hired, and advance in that occupational field. (Task lists are grouped according to duty areas generally used in industry settings, and are used as the basis for modules in the statewide curriculum guide development process and for generating student profiles.) The first section of the guide is the task profile, which provides the Idaho code number for the occupation and outlines major concepts/content, laboratory activities, teaching considerations, and intended outcomes. The guide then lists 44 task areas with subtasks (competencies) for electronic technology, grouped into the following six modules: basic electronic skills; communications electronics; electronic product servicing; computer servicing technology; electromechanical technology; and electro-optic technology. (KC)

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TECHNICAL COMMITTEE REPORT FOR

ELECTRONIC TECHNOLOGY

Invest in Success

IDAHO VTE
VOCATIONAL TECHNICAL EDUCATION

STATE DIVISION OF VOCATIONAL EDUCATION

CE061285

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INTRODUCTION

The curriculum development process undertaken by the Idaho Division of Vocational Education involves the active use of industry personnel. Industry personnel comprise the sole membership on Technical Committees which are responsible for the development of Task Lists for each program. A Technical Committee Report is prepared on completion of the Committee's assignment. This publication is the Technical Committee Report.

The Task List prepared in the Technical Committee Report reflect the current trends and skills necessary for an employee to: 1) Obtain a job in Idaho's industry, 2) retain a job once hired, and, 3) to advance in the occupational field. Task Lists are grouped according to Duty areas generally used in industry settings. Duty areas are used as the basis for modules in the Statewide Curriculum Guide development process. The Technical Committee segment is the single most significant step in the curriculum development process. All future curriculum activities are predicated on the premise that an accurate picture of industry needs are reflected in the Task List.

Instructional personnel are selected to develop the Statewide Curriculum Guide. These instructors write Performance Objectives for each Task and the subsequent Enabling Objectives for each Performance Objective. The committee members prepare all material in a competency-based format so as to have an effective and efficient methodology for determining student progress. The Statewide Guides are designed as the prime determiner of program content. All programs must follow the established Guide in order to be approved for operation. Any deviation from this Guide requires written approval from the respective program supervisor at the Division of Vocational Education. It is not the intent of the Division that all programs be designed to be exactly the same, but assurance is needed to ensure that the program meets the minimum standards for operation, based on the community needs, equipment, and facilities available to the local school or institution.

The Technical Committee Report does not dictate the level of instruction The Task List developed represents the entire occupational field. Schools and Institutions determine what skills can be taught and what depth of instruction can be provided. They must choose the Tasks to be taught from the Technical Committee Report but are free to determine how many or which ones can be incorporated into their program.

The Technical Committee Report is also used as the primary list for generating Student Profiles. These Profiles are used as a cumulative record of each student's progress. They are printed in a folder format and have levels of performance scales for each Task so that student competence can be recorded for individual skills or tasks. This document will become the main component for Articulation activities in the event that the student desires to go on for additional training or education.

ACKNOWLEDGEMENTS

The Technical Committee process involves personnel from industry who are selected by the Division with assistance from the State Council on Vocational Education. People who serve on the Committees are nominated by local administrators. They generally come from local advisory committees for existing Vocational Education programs or are community representatives in a capacity to provide the necessary information about industry needs. These people serve with the approval of their employers and give their time and energies to the project without cost. The Division provides reimbursement for per diem and travel. We are indebted greatly to these industry representatives and to their employers for the resources so freely given to the pursuit of ensuring that Idaho students receive the most current training and education possible and that which is demanded by industry.

To this end, the Division recognizes the following people who served on the Electronics Technical Committee: Paul Evans, Idaho Falls; Jeff Adams, Rupert; Steve Hall, Boise; Mike Bir, Boise; George Siegner, Coeur d'Alene; Glenn Brusse, Boise; Ernie Marks, Boise; Jim McIver, Lewiston; Rick Kramer, Pocatello; and Joy Chase, Rigby.

Your support and assistance was very greatly appreciated. Your patience for enduring the educational process is also noted. The students and instructional staff will be much more able to accomplish their respective goals as a result of your contributions.

Sho Ueda, Supervisor
Trades, Industrial & Technical Education

Don Eshelby
Director of Program Services

CURRICULUM FRAMEWORK

IDAHO DIVISION OF VOCATIONAL EDUCATION

PROGRAM TITLE: ELECTRONIC TECHNOLOGY

IDAHO CODE NUMBER: 6150, 5018

PROGRAM AREA: Trade & Industrial

REVISION DATE: October 1, 1991

CIP NUMBER: 47.0101, 15.0303

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1. MAJOR CONCEPTS/CONTENT: The purpose of this program is to prepare students for employment as electronic technicians or to provide supplemental training for persons previously or currently employed in these occupations.

   The content includes, but is not limited to, communication skills, leadership skills, human relations and employability skills, safe and efficient work practices, basic management concepts, troubleshooting skills, servicing, maintaining, and repairing all electronics related systems.

2. LABORATORY ACTIVITIES: Laboratory activities are an integral part of this program. These activities provide instruction in the use of tools, test equipment, materials, and processes used in Industry. Students will use various types of precision test equipment for analyzing, troubleshooting, and repairing computer and electronic circuitry.

3. SPECIAL NOTE:
   VICA - The Vocational Industrial Clubs of America, Inc. (VICA) is the vocational student organization which reinforces classroom instruction by providing communications, leadership, human relations, and employability training experiences. It also reinforces vocational skills. When provided, these activities are considered an integral part of this program.

   Cooperative Education - The cooperative method of instruction is utilized for this program. Whenever the cooperative method is offered, the following is required for each student: a training plan, signed by the student, teacher and employer which includes instructional objectives and a list of on the job and in school learning experiences; a training agreement for contractual obligations of both the school and employer; and a work station which reflects equipment, skills and tasks relevant to the occupation the student has chosen as a career goal.

   Basic algebra is recommended as a prerequisite for entry into this program. Applied algebraic skills will be provided as a component of the instructional content of this program.

4. The particular outcomes and student performance standards which the handicapped student must master to earn credit must be specified in the students' individual educational plan (IEP). Additional credits may be earned when outcomes and standards are mastered in accordance with the requirements indicated in subsequent IEP's. The job title for which the student is being trained must be designated in the IEP.

5. INTENDED OUTCOMES: Entry level employment requires the successful completion of all competencies in Module 1, BASIC ELECTRONIC SKILLS.

MODULE 1 - BASIC ELECTRONIC SKILLS

01. Demonstrate Employability Skills and Habits
02. Demonstrate Proficiency in Laboratory Practices
03. Demonstrate Proficiency in Technical Recording and Reporting
04. Demonstrate Proficiency in DC Circuits
05. Demonstrate Proficiency in AC Circuits
06. Demonstrate Proficiency in Discrete Solid-State Devices
07. Demonstrate Proficiency in Analog Circuits
08. Demonstrate Proficiency in Digital Circuits
09. Demonstrate Proficiency in Microprocessors
10. Demonstrate Proficiency in Customer Relations and Site Requirements

MODULE 2 - COMMUNICATIONS ELECTRONICS OPTION

01. Demonstrate Proficiency in RF Systems Safety
02. Demonstrate Proficiency in Transmission Line Applications
03. Demonstrate Proficiency in Antenna Systems
04. Demonstrate Proficiency in Radio Transmitters and Receivers
05. Demonstrate Proficiency in Various Types of Multiplexing Systems
06. Demonstrate Proficiency in Data Communications
07. Demonstrate Proficiency in Fiber Optic Communications Systems
08. Demonstrate Proficiency in Various Types of Telephony Switching Systems

MODULE 3 - ELECTRONIC PRODUCT SERVICING OPTION

01. Demonstrate Proficiency in Surface Mounted Devices (SMD)
02. Demonstrate Proficiency in Radio and Television Receiving Systems
03. Demonstrate Proficiency in Video Recording and Playback Systems (Analog and Digital)
04. Demonstrate Proficiency in Laser Disc Systems
05. Demonstrate Proficiency in Home Electronics Systems
06. Demonstrate Proficiency in Audio Systems (Analog and Digital)
07. Demonstrate Proficiency in Antenna Systems (CATV/SATV)
08. Demonstrate Proficiency in Customer Relations and Site Requirements

MODULE 4 - COMPUTER SERVICING TECHNOLOGY OPTION

01. Demonstrate Proficiency in Computer System Architecture
02. Demonstrate Proficiency in Computer Programming Fundamentals
03. Demonstrate Proficiency in Communication Interfacing
04. Demonstrate Proficiency in Peripheral Equipment

MODULE 5 - ELECTROMECHANICAL TECHNOLOGY OPTION

01. Demonstrate Proficiency in Electronic and Mechanical Blueprint Reading
02. Demonstrate Proficiency in Motors and Motor Control Circuits
03. Demonstrate Proficiency in Hydraulic and Pneumatic Systems
04. Demonstrate Proficiency in Mechanical Power Transmission Systems
05. Demonstrate Proficiency in Vacuum Systems
06. Demonstrate Proficiency in Mechanisms, Linkages and Levers
07. Demonstrate Proficiency in Transducers and Instrumentation
08. Demonstrate Proficiency in Industrial Materials
09. Demonstrate Proficiency in Automatic Controls and Robotics

MODULE 6 - ELECTRO-OPTIC TECHNOLOGY OPTION

01. Demonstrate Proficiency in Principles of Light
02. Demonstrate Proficiency in Optical Systems and Elements
03. Demonstrate Proficiency in Lasers
04. Demonstrate Proficiency in Laser Energy Applications
05. Demonstrate Proficiency in Laser Applications

STUDENT PERFORMANCE STANDARDS | EFFECTIVE DATE:October, 1991

PROGRAM AREA: Trade and Industrial | SECONDARY:_____

PROGRAM TITLE: Electronic Technology | POSTSECONDARY:_____

MODULE 1 COMPRISES THE BASIC ELECTRONIC TECHNICIAN PROGRAM. MODULES 2-6 COMPRISE THE OPTIONAL PROGRAM COMPONENTS. A PROGRAM CAN OFFER ANY OR ALL OPTIONAL MODULES BUT IS REQUIRED TO PROVIDE INSTRUCTION TO ALL STUDENTS IN THE 10 DUTY AREAS IDENTIFIED IN THE BASIC ELECTRONICS SKILLS (MODULE 1).

> **NOTE: Basic Algebra, as applied to (Ohms Law and Impedance formula applications) is recommended as a prerequisite for the Electronics program. All other math applicable to Electronics program will be taught as applied math throughout the program.**

MODULE 1 - BASIC ELECTRONIC SKILLS

01.0 DEMONSTRATE EMPLOYABILITY SKILLS AND HABITS

The student will be able to:

- **01.01 Identify employment opportunities.**
- **01.02 Apply employment-seeking skills.**
- **01.03 Interpret employment capabilities.**
- **01.04 Demonstrate appropriate work behavior.**
- **01.05 Maintain a business-like image.**
- **01.06 Maintain working relationships with others.**
- **01.07 Communicate on the job in oral, written, and electronic format.**
- **01.08 Adapt to change.**
- **01.09 Demonstrate a knowledge of business operation.**
- **01.10 Discuss multi-racial/cultural implications in the workforce.**

02.0 DEMONSTRATE PROFICIENCY IN LABORATORY PRACTICES

The student will be able to:

- **02.01 Apply proper OSHA safety standards.**
- **02.02 Demonstrate proficiency in troubleshooting techniques**
- **02.03 Practice good electrostatic discharge (ESD) damage prevention.**
- **02.04 Identify and use hand tools properly.**
- **02.05 Identify and use power tools properly.**
- **02.06 Demonstrate acceptable soldering and desoldering techniques, including through-hole and surface mount device applications.**
- **02.07 Demonstrate ability to make proper solderless connections.**
- **02.08 Interpret and demonstrate written, graphic and/or oral instruction.**

02.09 Develop basic electronic assembly skills.
02.10 Document all lab projects/procedures in a clear concise written format.

03.0 DEMONSTRATE PROFICIENCY IN TECHNICAL RECORDING AND REPORTING
The student will be able to:

03.01 Draw and interpret electronic schematics.
03.02 Record data and design curves and graphs.
03.03 Write reports and make oral presentations.
03.04 Maintain test logs.
03.05 Prepare equipment-failure reports.
03.06 Specify and requisition simple electronic components.
03.07 Compose technical letters and memoranda.
03.08 Write formal reports of laboratory experiences.
03.09 Draft preventive maintenance and calibration procedures.
03.10 Demonstrate ability to use data books and cross reference/technical manuals.

04.0 DEMONSTRATE PROFICIENCY IN DC CIRCUITS
The student will be able to:

04.01 Practice proper safety techniques.
04.02 Solve problems in electronic units utilizing metric prefixes.
04.03 Relate electricity to the nature of matter.
04.04 Identify sources of electricity.
04.05 Describe the principles and operation of electrochemical supplies.
04.06 Describe voltage, current, resistance, power, and energy.
04.07 Apply Ohm's law and power formulas.
04.08 Read and interpret color codes and symbols to identify electrical components and values.
04.09 Measure properties of a circuit using analog and digital meters and oscilloscopes.
04.10 Compute conductance and measure resistance of conductors and insulators.
04.11 Apply Ohm's law to series circuits.
04.12 Demonstrate the operation of series circuits.
04.13 Troubleshoot and repair series circuits.
04.14 Apply Ohm's law to parallel circuits.
04.15 Demonstrate the operation of parallel circuits.
04.16 Troubleshoot and repair parallel circuits.
04.17 Apply Ohm's law to series-parallel circuits.
04.18 Demonstrate the operation of series-parallel and bridge circuits.
04.19 Troubleshoot and repair series-parallel and bridge circuits.
04.20 Demonstrate the operation of voltage divider circuits (loaded & unloaded).
04.21 Troubleshoot and repair voltage divider circuits (loaded and unloaded).
04.22 Demonstrate the maximum power transfer theory.
04.23 Describe magnetic properties, circuits and devices.
04.24 Determine the physical and electrical characteristics of capacitors and inductors.
04.25 Describe RC and RL time constants and classify the output of differentiators and integrators.
04.26 Set up and operate power supplies for DC circuits.

05.0 DEMONSTRATE PROFICIENCY IN AC CIRCUITS

The student will be able to:

- **05.01** Practice proper safety techniques.
- **05.02** Analyze properties of an AC signal.
- **05.03** Describe the principle and operation of the characteristics of sinusoidal and non-sinusoidal wave forms.
- **05.04** Identify AC sources.
- **05.05** Measure AC signals utilizing analog and digital meters, oscilloscope, frequency counter,and function generator.
- **05.06** Describe the principle and operation of the characteristics of capacitive circuits.
- **05.07** Demonstrate the operation of capacitive circuits.
- **05.08** Troubleshoot and repair capacitive circuits.
- **05.09** Describe the principle and operation of the characteristics of inductive circuits.
- **05.10** Demonstrate the operation of inductive circuits.
- **05.11** Troubleshoot and repair inductive circuits.
- **05.12** Describe the principle and operation of the principles of transformers.
- **05.13** Demonstrate the operation of AC circuits utilizing transformers.
- **05.14** Troubleshoot and repair AC circuits utilizing transformers.
- **05.15** Demonstrate the operation of differentiators and integrators to determine RC and RL time constants.
- **05.16** Troubleshoot and repair differentiator and integrator circuits.
- **05.17** Describe the principle and operation of the characteristics of RLC circuits (series, parallel, and complex).
- **05.18** Demonstrate the operation of RLC circuits (series, parallel, and complex).
- **05.19** Describe the principle and operation of the characteristics of series and parallel resonant circuits.
- **05.20** Demonstrate the operation of series and parallel resonant circuits.
- **05.21** Troubleshoot and repair RC, RL, and RLC circuits.
- **05.22** Describe the principle and operation of the characteristics of frequency selective filter circuits.
- **05.23** Demonstrate the operation of frequency selective filter circuits.
- **05.24** Troubleshoot and repair frequency selective filter circuits.
- **05.25** Describe the principle and operation of the characteristics of polyphase circuits.
- **05.26** Describe basic motor theory and operation.
- **05.27** Describe basic generator theory and operation.
- **05.28** Operate power supplies for AC circuits.
- **05.29** Measure power in AC circuits.
- **05.30** Operate capacitor/inductor analyzers for AC circuits.
- **05.31** Describe the principle and operation of various power conditioning (eg. isolation transformers, surge suppressors, uninterruptable power systems).
- **05.32** Describe the principle and operation of various safety grounding systems (eg. lightning arresters, ground fault interrupters, etc.).

06.0 DEMONSTRATE PROFICIENCY IN DISCRETE SOLID-STATE DEVICES

The student will be able to:

06.01 Practice proper safety techniques.
06.02 Describe properties of semiconductor materials.
06.03 Describe operating characteristics and applications of PN junctions.
06.04 Demonstrate the operation of diode circuits.
06.05 Troubleshoot and repair diode circuits.
06.06 Describe operating characteristics and applications of bipolar transistors.
06.07 Describe operating characteristics and applications of field effect transistors (FET's/MOS-FET's).
06.08 Describe operating characteristics and application of special diodes/transistors.
06.09 Describe the operating characteristics and applications of optoelectronic devices (gate isolators, interrupt sensors, infra red sensors, etc).
06.10 Demonstrate the operation of optoelectronic circuits. (gate isolators, interrupt sensors, infra red sensors, etc.)
06.11 Troubleshoot and repair optoelectronic circuits. (gate isolators, interrupt sensors, infra red sensors, etc.)
06.12 Describe operating characteristics and applications of single-stage amplifiers.
06.13 Demonstrate the operation of the single-stage amplifiers.
06.14 Troubleshoot and repair single-stage amplifiers.
06.15 Demonstrate the operation of thyristor circuitry (SCR, TRIAC, DIAC., etc.).
06.16 Troubleshoot and repair thyristor circuitry. (SCR, TRIAC, DIAC, etc.)
06.17 Operate analog and digital equipment for solid-state devices.
06.18 Operate power supplies for solid-state devices.
06.19 Operate oscilloscopes for solid-state devices.
06.20 Operate function generators for solid-state devices.
06.21 Operate curve tracers.
06.22 Operate transistor testers.

07.0 DEMONSTRATE PROFICIENCY IN ANALOG CIRCUITS

The student will be able to:

07.01 Practice proper safety techniques.
07.02 Operate measuring instruments for analog circuits.
07.03 Describe operational characteristics and applications of multistage amplifiers.
07.04 Demonstrate the operation of multistage amplifiers.
07.05 Troubleshoot and repair multistage amplifiers.
07.06 Describe operating characteristics and applications of linear integrated circuits.
07.07 Describe operating characteristics and applications of power supplies and filters.
07.08 Demonstrate the operation of power supplies and filters.
07.09 Troubleshoot and repair power supplies and filters.
07.10 Describe operating characteristics and applications of operational amplifier circuits.
07.11 Demonstrate the operation of operational amplifier circuits.

07.12 Troubleshoot and repair operational amplifier circuits.
07.13 Describe the operating characteristics of audio power amplifiers.
07.14 Demonstrate the operation of audio power amplifiers.
07.15 Troubleshoot and repair audio power amplifiers.
07.16 Describe the operating characteristics and applications of regulated and switching power supply circuits.
07.17 Demonstrate the operation of regulated power supply circuits.
07.18 Troubleshoot and repair regulated and switching power supply circuits.
07.19 Describe operating characteristics and applications of active filters.
07.20 Demonstrate the operation of active filter circuits.
07.21 Troubleshoot and repair active filter circuits.
07.22 Describe operating characteristics and applications of sinusoidal and non-sinusoidal oscillator circuits.
07.23 Demonstrate the operation of oscillator circuits.
07.24 Troubleshoot and repair oscillator circuits.
07.25 Describe the operating characteristics and applications of motor phase-shift control circuits (single-phase and multi-phase).
07.26 Describe the operating characteristics and applications of cathode ray tubes.
07.27 Describe the operating characteristics and application of fiber optics.
07.28 Demonstrate the operation of fiber optics.
07.29 Troubleshoot and repair fiber optics.

08.0 DEMONSTRATE PROFICIENCY IN DIGITAL CIRCUITS

The student will be able to:

08.01 Practice proper safety techniques.
08.02 Operate logic probes for digital circuits.
08.03 Operate power supplies for digital circuits.
08.04 Troubleshoot and repair power distribution and noise problems.
08.05 Operate pulsers for digital circuits.
08.06 Operate oscilloscopes for digital circuits.
08.07 Describe characteristics of integrated circuit (IC) logic families.
08.08 Describe the principle and operation of types of logic gates and their truth tables.
08.09 Demonstrate the use of logic gates.
08.10 Troubleshoot and repair logic gates.
08.11 Describe the principle and operation of combinational logic circuits.
08.12 Demonstrate the operation of combinational logic circuits.
08.13 Troubleshoot and repair combinational logic circuits.
08.14 Describe the principle and operation of numbering systems, codes, arithmetic operations and Boolean operations.
08.15 Minimize logic circuits using Boolean operations.
08.16 Describe the principle and operation of types of flip-flops.
08.17 Demonstrate the operation of flip-flops.
08.18 Troubleshoot and repair flip-flops.
08.19 Describe the principle and operation of types of registers and counters.
08.20 Demonstrate the operation of registers and counters.

08.21 Troubleshoot and repair registers and counters.
08.22 Describe the principle and operation of clock and timing circuits.
08.23 Demonstrate the operation of clock and timing circuits.
08.24 Troubleshoot and repair clock and timing circuits.
08.25 Describe the principle and operation of types of arithmetic-logic circuits.
08.26 Demonstrate the operation of arithmetic-logic circuits.
08.27 Troubleshoot and repair arithmetic-logic circuits.
08.28 Describe the principle and operation of types of encoders and decoders.
08.29 Demonstrate the operation of encoders and decoders.
08.30 Troubleshoot and repair encoders and decoders.
08.31 Describe the principle and operation of types of multiplexer and demultiplexer circuits.
08.32 Demonstrate the operation of multiplexer and demultiplexer circuits.
08.33 Troubleshoot and repair multiplexer and demultiplexer circuits.
08.34 Describe the principle and operation of digital-to-analog and analog-to-digital circuits.
08.35 Demonstrate the operation of digital-to-analog and analog-to-digital circuits.
08.36 Troubleshoot and repair digital-to-analog and analog-to-digital circuits.
08.37 Describe the principle and operation of types of digital display circuits.
08.38 Demonstrate the operation of digital display circuits.
08.39 Troubleshoot and repair digital display circuits.
08.40 Describe the types of digital display devices.
08.41 Demonstrate the operation of digital display devices.
08.42 Troubleshoot and repair digital display devices.

09.0 DEMONSTRATE PROFICIENCY IN MICROPROCESSORS

The student will be able to:

09.01 Practice proper safety techniques.
09.02 Describe the essential components of a microprocessor and their functions.
09.03 Operate oscilloscopes and logic/data analyzers.
09.04 Describe the principle and operation of BUS concepts.
09.05 Describe the principle and operation of types of memory circuits.
09.06 Demonstrate the operation of memory circuits.
09.07 Troubleshoot and repair memory circuits.
09.08 Describe microprocessor instruction sets.
09.09 Describe the principles and operation of microprocessor machine code.
09.10 Demonstrate the use of microprocessor machine code.
09.11 Troubleshoot (debug) microprocessor machine code.
09.12 Describe types of peripherals.
09.13 Demonstrate ability to interface peripherals.

10.00 DEMONSTRATE PROFICIENCY IN CUSTOMER RELATIONS AND SITE REQUIREMENTS

The student will be able to:

10.01 Apply effective customer relations techniques.
10.02 Describe the principles of installation and servicing techniques.
10.03 Describe power requirements.
10.04 Describe environmental requirements.
10.05 Describe preventive maintenance requirements.

MODULE 2 - COMMUNICATIONS ELECTRONICS OPTION

01.0 DEMONSTRATE PROFICIENCY IN RF SYSTEMS SAFETY

The student will be able to:

- **01.01 Describe safety procedures for working with RF systems antennae.**
- **01.02 Demonstrate safety procedures for working with RF systems antennae.**
- **01.03 Demonstrate safety procedures for working with RF systems high voltage/power supply.**
- **01.04 Demonstrate safety procedures for working with RF generators.**
- **01.05 Demonstrate safety procedures for working with RF systems in confined space.**

02.0 DEMONSTRATE PROFICIENCY IN TRANSMISSION LINE APPLICATIONS

The student will be able to:

- **02.01 Practice proper safety techniques.**
- **02.02 Describe the principle and operation of two wire transmission lines.**
- **02.03 Demonstrate operation of two wire transmission lines.**
- **02.04 Troubleshoot and repair two wire transmission lines.**
- **02.05 Describe the principle and operation of coaxial cable.**
- **02.06 Demonstrate operation of coaxial cable.**
- **02.08 Troubleshoot and repair coaxial cable.**
- **02.09 Describe the principle and operation of wave guide.**
- **02.10 Demonstrate operation of wave guide.**
- **02.11 Troubleshoot and repair wave guide.**
- **02.12 Describe the principle and operation of fiber optics.**
- **02.13 Demonstrate operation of fiber optics.**
- **02.14 Troubleshoot and repair fiber optics.**

03.0 DEMONSTRATE PROFICIENCY IN ANTENNA SYSTEMS

The student will be able to:

- **03.01 Practice proper safety techniques.**
- **03.02 Describe the principle and operation of single element antennae (eg. 1/4 wave dipole, longwire, vertical).**
- **03.03 Demonstrate operation of single element antennae.**
- **03.04 Troubleshoot and repair single element antennae.**
- **03.05 Describe the principle and operation of multi-element antennae (eg. parabolic, directional).**
- **03.06 Demonstrate operation of multi-element antennae.**
- **03.07 Troubleshoot and repair multi-element antennae.**
- **03.08 Describe the principle and operation of impedance matching of antennae systems.**
- **03.09 Demonstrate impedance matching of antennae systems.**
- **03.10 Troubleshoot and repair impedance matching of antennae systems.**
- **03.11 Describe antennae systems measurement.**
- **03.12 Demonstrate antennae systems measurements.**
- **03.13 Troubleshoot and repair antennae systems.**

04.0 DEMONSTRATE PROFICIENCY IN TRANSMITTERS AND RECEIVERS

The student will be able to:

04.01 Practice proper safety techniques.
04.02 Discuss Federal Communication Commission (FCC) rules and regulations.
04.03 Describe the principle and operation of R.F. amplifiers.
04.04 Demonstrate operation of R.F. amplifiers.
04.05 Troubleshoot and repair R.F. amplifiers.
04.06 Describe the principle and operation of modulation/de-modulation (eg. AM, FM, SSB, DSSC).
04.07 Demonstrate operation of modulation/de-modulation.
04.08 Troubleshoot and repair modulation/de-modulation circuits.
04.09 Describe the principle and operation of AM transmitters and receivers (incl. SSB, DSSC).
04.10 Demonstrate operation of AM transmitters and receivers.
04.11 Troubleshoot and repair AM transmitters and receivers.
04.12 Describe the principle and operation of FM transmitters and receivers (incl. SSB, DSSC).
04.13 Demonstrate operation of FM transmitters and receivers.
04.14 Troubleshoot and repair FM transmitters and receivers.
04.15 Describe the principle and operation of microwave and satellite communication systems.
04.16 Demonstrate operation of microwave and satellite communication systems.
04.17 Troubleshoot and repair microwave and satellite communication systems.
04.18 Describe the principle and operation of repeater systems.
04.19 Demonstrate the operation of repeater systems.
04.20 Troubleshoot and repair repeater systems.

05.0 DEMONSTRATE PROFICIENCY IN VARIOUS TYPES OF MULTIPLEXING SYSTEMS

The student will be able to:

05.01 Practice proper safety techniques.
05.02 Describe the principle and operation of analog multiplexing systems (eg. CATV).
05.03 Describe the principle and operation of digital multiplexing systems (eg. T-1).
05.04 Describe the principle and operation of television modulation.
05.05 Demonstrate television modulation.
05.06 Troubleshoot and repair television modulation circuits.

06.0 DEMONSTRATE PROFICIENCY IN DATA COMMUNICATIONS

The student will be able to:

06.01 Practice proper safety techniques.
06.02 Describe the principle and operation of signalling systems, codes, formats and protocols.
06.03 Describe the principle and operation of parallel and serial ports.
06.04 Describe the principle and operation of synchronous and asynchronous signals.
06.05 Describe the principle and operation of data modems.
06.06 Demonstrate operation of data modems.

06.07 Troubleshoot and repair data modems.
06.08 Describe the principle and operation of fax machines.
06.09 Describe the principle and operation of types of carrier systems.
06.10 Describe the principle and operation of various types of LANs (eg. ethernet, token ring, etc.).
06.11 Demonstrate operation of various types of LANs.
06.12 Troubleshoot and repair various types of LANs.

07.0 DEMONSTRATE PROFICIENCY IN FIBER OPTIC COMMUNICATIONS SYSTEMS
The student will be able to:

07.01 Practice proper safety techniques.
07.02 Describe the basic characteristics of optics such as reflection, refraction and total reflection.
07.03 Describe the characteristics and components of fiber optic cables.
07.04 Describe the modes of propagation used in fiber optic cables.
07.05 Discuss bandwidth and attenuation limitations for fiber optic systems.
07.06 Describe the technique of wavelength multiplexing in fiber optic cables.
07.07 Describe the characteristics of various types of light sources and light detectors used in fiber optic systems.
07.08 Describe the components of fiber optic transmission systems.
07.09 Demonstrate the operation of a simple fiber optic data transmission system.
07.10 Troubleshoot and repair the components of fiber optic data transmission systems.

08.0 DEMONSTRATE PROFICIENCY IN VARIOUS TYPES OF TELEPHONY SWITCHING SYSTEMS.
The student will be able to:

08.01 Practice proper safety techniques.
08.02 Describe the principle and operation of traffic flow (eg. blocking and grade of service).
08.03 Describe the principle and operation of signaling systems (eg. rotary, touch tone).
08.04 Describe the principle and operation of various components of a telephony switching system (eg. lines, trunks, network, control and testing).

MODULE 3 - ELECTRONIC PRODUCT SERVICING OPTION

01.0 DEMONSTRATE PROFICIENCY IN SURFACE MOUNTED DEVICES (SMD)

The student will be able to:

- **01.01** Practice proper safety techniques.
- **01.02** Describe the principle and operation of types of surface mounted devices (SMD's) for DC, AC and solid-state circuits.
- **01.03** Describe the proper procedure for handling static sensitive devices.
- **01.04** Locate defective SMD's using appropriate troubleshooting techniques.
- **01.05** Replace SMD's using appropriate troubleshooting techniques.

02.0 DEMONSTRATE PROFICIENCY IN RADIO AND TELEVISION RECEIVING SYSTEMS

The student will be able to:

- **02.01** Practice proper safety techniques.
- **02.02** Interpret radio and television receiving system block diagrams.
- **02.03** Describe the principle and operation of a superhetrodyne receiver.
- **02.04** Construct a superhetrodyne receiver.
- **02.05** Align a superhetrodyne receiver.
- **02.06** Troubleshoot and repair a superhetrodyne receiver.
- **02.07** Describe the principles of video signal generation.
- **02.08** Describe the principle and operation of TV circuits.
- **02.09** Demonstrate the operation of TV circuits.
- **02.10** Troubleshoot and repair TV circuits.
- **02.11** Perform operating systems check and make adjustments to radio and television receiving systems.
- **02.12** Discuss High Definition Television systems.
- **02.13** Operate video analyzers.
- **02.14** Operate National Television Signal Codes (NTSC) generators.
- **02.15** Operate cathode ray tube (CRT) analyzers.
- **02.16** Operate stereo generators.

03.0 DEMONSTRATE PROFICIENCY IN VIDEO RECORDING AND PLAYBACK SYSTEMS (ANALOG AND DIGITAL)

The student will be able to:

- **03.01** Practice proper safety techniques.
- **03.02** Describe characteristics associated with recording and layback systems.
- **03.03** Interpret video recording system block and circuit diagrams.
- **03.04** Determine the operational status of video recording systems (mechanical and electronic).
- **03.05** Troubleshoot and repair video recording systems.
- **03.06** Perform operating systems check and make adjustments to video recording systems.
- **03.07** Describe the operating characteristics and application of BETA, VHS and 8mm test equipment.
- **03.08** Demonstrate the operating characteristics and application of BETA, VHS and 8mm test equipment.

03.09 Operate vectorscopes and wave form monitors.
03.10 Describe the operating characteristics and application of BETA, VHS and 8mm recorders and playback systems.
03.11 Troubleshoot and repair BETA, VHS and 8 mm recorders and playback systems.
03.12 Describe the operating characteristics and application of camcorders.
03.14 Demonstrate the operating characteristics and application of camcorders.
03.15 Troubleshoot and repair camcorders.

04.00 DEMONSTRATE PROFICIENCY IN LASER DISC SYSTEMS

The student will be able to:

04.01 Practice proper safety techniques.
04.02 Describe characteristics associated with laser disc systems.
04.03 Interpret laser disc system blocks and circuit diagrams.
04.04 Describe the operation of laser disc systems.
04.05 Demonstrate the operation of laser disc systems.
04.06 Troubleshoot and repair laser disc systems.
04.07 Replace and align laser disc system components.
04.08 Describe the principle and operation of interactive video.

05.00 DEMONSTRATE PROFICIENCY IN HOME ELECTRONICS SYSTEMS

The student will be able to:

05.01 Practice proper safety techniques.
05.02 Describe characteristics associated with home automation systems (eg. computers and peripherals).
05.03 Interpret home automation systems block and circuit diagrams.
05.04 Describe the operation of home automation systems.
05.05 Troubleshoot and repair home automation systems.
05.06 Replace and align home automation systems.
05.07 Describe the principle and operation of Fax machines.
05.08 Demonstrate the operation of Fax machines.
05.09 Troubleshoot and repair Fax machines.
05.10 Describe the principle and operation of personal computer games.
05.11 Demonstrate the operation of personal computer games.
05.12 Troubleshoot and repair personal computer games.
05.13 Describe the principle and operation of personal telephones.
05.14 Demonstrate the operation of personal telephones.
05.15 Troubleshoot and repair personal telephones.
05.16 Describe characteristics associated with electronic security systems.
05.17 Describe the installation of an electronic security systems.
05.18 Demonstrate the operation of electronic security systems.
05.19 Troubleshoot and repair electronic security systems.
05.20 Replace and align electronic security system components.

06.0 DEMONSTRATE PROFICIENCY IN AUDIO SYSTEMS (ANALOG AND DIGITAL)

The student will be able to:

- 06.01 Practice proper safety techniques.
- 06.02 Describe the principle and operation of audio systems.
- 06.03 Interpret audio systems block and circuit diagrams.
- 06.04 Demonstrate the operation of audio systems.
- 06.05 Troubleshoot and repair audio systems.
- 06.06 Replace and align audio system components.
- 06.07 Describe the principle and operation of digital audio tape (DAT).
- 06.08 Describe the principle and operation of digital compact cassette (DCC).

07.0 DEMONSTRATE PROFICIENCY IN ANTENNA SYSTEMS (CATV/SATV)

The student will be able to:

- 07.01 Practice proper safety techniques.
- 07.02 Describe the principle and operation of antennae systems.
- 07.03 Demonstrate the installation of antenna systems.
- 07.04 Troubleshoot and repair antenna systems.
- 07.05 Replace and align antenna system components.
- 07.06 Describe the principle and operation of a CATV system.
- 07.07 Demonstrate the operation of a CATV system.
- 07.08 Troubleshoot and repair a CATV system.
- 07.09 Describe the principle and operation of a SATV system.
- 07.10 Demonstrate the operation of a SATV system.
- 07.11 Troubleshoot and repair a SATV system.

08.0 DEMONSTRATE PROFICIENCY IN CUSTOMER RELATIONS AND SITE REQUIREMENTS

The student will be able to:

- 08.01 Apply effective customer relations techniques.
- 08.02 Describe the principle of installation and servicing techniques.
- 08.03 Describe power requirements.
- 08.04 Describe environmental requirements.
- 08.05 Describe preventive maintenance requirements.

MODULE 4 - COMPUTER SERVICING TECHNOLOGY OPTION

01.0 DEMONSTRATE PROFICIENCY IN COMPUTER SYSTEM ARCHITECTURE
The student will be able to:

- **01.01 Practice proper safety techniques.**
- **01.02 Describe the principle and operation of computer system architecture.**
- **01.03 Demonstrate the operation of computer system architecture.**
- **01.04 Troubleshoot and repair computer system architectures.**
- **01.05 Describe the principle and operation of addresses and interrupts.**
- **01.06 Demonstrate the use of addresses and interrupts.**
- **01.07 Troubleshoot and repair addresses and interrupts.**
- **01.08 Describe the principle and operation of volatile and non-volatile memory.**
- **01.09 Demonstrate the use of volatile and non-volatile memory.**
- **01.10 Troubleshoot and repair volatile and non-volatile memory.**
- **01.11 Describe the principle and operation of advanced memory techniques.**
- **01.12 Demonstrate the use of advanced memory techniques.**
- **01.13 Troubleshoot and repair advanced memory techniques.**

02.0 DEMONSTRATE PROFICIENCY IN COMPUTER PROGRAMMING FUNDAMENTALS
The student will be able to:

- **02.01 Practice proper media handling techniques.**
- **02.02 Operate system software.**
- **02.03 Operate diagnostic software.**
- **02.04 Construct flow charts.**
- **02.05 Analyze flow charts.**
- **02.06 Describe computer languages and their uses.**
- **02.07 Write a simple computer program using a high level language.**
- **02.08 Write a computer program in assembly language.**
- **02.09 Write a computer program in machine language.**

03.0 DEMONSTRATE PROFICIENCY IN COMMUNICATION INTERFACING
The student will be able to:

- **03.01 Practice proper safety techniques.**
- **03.02 Describe EIA, IEEE, CCITT, and public switch telephone network standards.**
- **03.03 Describe ASCII coding system.**
- **03.04 Describe the principle and operation of synchronous devices.**
- **03.05 Describe the principle and operation of asynchronous devices.**
- **03.06 Describe the principle and operation of hardware and software networking levels or layers.**
- **03.07 Describe the principle and operation of protocols.**
- **03.08 Describe the principle and operation of packet switching.**
- **03.09 Describe principle and operation of multi-user systems.**

04.0 DEMONSTRATE PROFICIENCY IN PERIPHERAL EQUIPMENT

The student will be able to:

04.01 Practice proper safety techniques.
04.02 Identify types of peripheral equipment and interface controllers.
04.03 Describe the principle and operation of display terminals and interface controllers.
04.05 Demonstrate the use of display terminals and interface controllers.
04.06 Troubleshoot and repair display terminals and interface controllers.
04.07 Describe the principle and operation of printers and interface devices.
04.08 Demonstrate the use of printers and interface controllers.
04.09 Troubleshoot and repair printers and interface controllers.
04.10 Describe the operation of magnetic tape equipment and interface controllers.
04.11 Demonstrate the use of magnetic tape equipment and interface controllers.
04.12 Troubleshoot and repair magnetic tape and interface controllers.
04.13 Describe the principle and operation of disk equipment and interface controllers.
04.14 Demonstrate the use of disk equipment and interface controllers.
04.15 Troubleshoot and repair and repair disk equipment and interface controllers.
04.16 Describe the principle and operation of cabling interconnects.
04.17 Demonstrate the use of cabling interconnects.
04.18 Troubleshoot and repair cabling interconnects.

MODULE 5 - ELECTROMECHANICAL TECHNOLOGY OPTION

01.0 DEMONSTRATE PROFICIENCY IN ELECTRONIC AND MECHANICAL BLUEPRINT READING
The student will be able to:

- **01.01 Describe types of blueprints and their applications.**
- **01.02 Read drawings and transfer measurements.**
- **01.03 Describe the application of auxiliary views, revolutions and sectional views.**
- **01.04 Describe dimensioning practices and techniques on drawings.**
- **01.05 Interpret mechanical/electronic production blueprints and assembly drawings.**

02.0 DEMONSTRATE PROFICIENCY IN MOTORS AND MOTOR CONTROL CIRCUITS
The student will be able to:

- **02.01 Practice proper safety techniques.**
- **02.02 Describe characteristics associated with motors and motor control circuits.**
- **02.03 Demonstrate the ability to use the National Electric Code and other electrical standards.**
- **02.04 Describe power distribution systems.**
- **02.05 Demonstrate the operation of a power distribution system.**
- **02.06 Troubleshoot and repair a power distribution system.**
- **02.07 Describe the operation of relays and relay circuits.**
- **02.08 Demonstrate the use of relays and relay circuits.**
- **02.09 Troubleshoot and repair relays and relay circuits.**
- **02.10 Describe the operation and applications of protection circuits for electric motors.**
- **02.11 Demonstrate the use of protection circuits for electric motors.**
- **02.12 Troubleshoot and repair protection circuits for electric motors.**
- **02.13 Describe the operation and application of various types of motor controllers (eg. steppers, starting and reversing, phase shift, solid state, timing, basic servo, variable frequency).**
- **02.14 Demonstrate the use of various types of motor controllers.**
- **02.15 Troubleshoot and repair the various types of motor controllers.**
- **02.16 Describe the operation and application of various motors (eg. synchronous, asynchronous, AC, DC, brushless, stepper, etc.).**
- **02.17 Demonstrate the use of various motors.**
- **02.18 Troubleshoot and repair various motors.**

03.0 DEMONSTRATE PROFICIENCY IN HYDRAULIC AND PNEUMATIC SYSTEMS
The student will be able to:

- **03.01 Practice proper safety techniques.**
- **03.02 Describe the principle and operation of hydraulic systems.**
- **03.03 Demonstrate the use of hydraulic systems.**
- **03.04 Troubleshoot and repair hydraulic systems.**
- **03.05 Describe the principle and operation of pneumatic systems.**
- **03.06 Describe gas pressure storage and force in basic pneumatic systems.**
- **03.07 Demonstrate the use of pneumatic systems.**
- **03.08 Troubleshoot and repair pneumatic systems.**

04.0 DEMONSTRATE PROFICIENCY IN MECHANICAL POWER TRANSMISSION SYSTEMS

The student will be able to:

04.01 Practice proper safety techniques.
04.02 Utilize precision measuring instruments.
04.04 Describe the principle and operation of compound and reverted gear trains.
04.05 Describe the principle and operation of internal and planetary gear trains.
04.06 Describe the principle and operation of helical and bevel gear trains.
04.07 Describe the principle and operation of rack and pinion, worm and wheel and block and screw mechanisms.
04.08 Describe the principle and operation of counter rotating mechanisms and differentials.
04.09 Describe the principle and operation of spring mechanisms, pulley blocks and differentials.
04.10 Describe the principle and operation of chain, belt and disc drives and universal joints.
04.11 Describe the principle and operation of clutch and coupling mechanisms.
04.12 Describe the principle and operation of braking mechanisms.
04.13 Describe the principle and operation of harmonic devices.
04.14 Replace and align bearings, bushings and cams.
04.15 Apply proper lubrication to mechanical system components.
04.16 Describe the necessity for proper alignment of mechanical devices.

05.0 DEMONSTRATE PROFICIENCY IN VACUUM SYSTEMS

The student will be able to:

05.01 Practice proper safety techniques.
05.02 Describe characteristics associated with vacuum systems and sub atmospheric pressure.
05.03 Describe the principle and operation of vacuum gauges.
05.04 Demonstrate the use of vacuum gauges.
05.05 Troubleshoot and repair vacuum gauges.
05.06 Describe the principle and operation of vacuum pumps.
05.07 Demonstrate the use of vacuum pumps.
05.08 Troubleshoot and repair vacuum pumps.
05.09 Describe the principle and operation of vacuum controls.
05.10 Demonstrate the use of vacuum controls.
05.11 Troubleshoot and repair vacuum controls.

06.0 DEMONSTRATE PROFICIENCY IN MECHANISMS, LINKAGES AND LEVERS

The student will be able to:

06.01 Practice proper safety techniques.
06.02 Describe class one, two, three and compound levers.
06.03 Describe the principle and operation of rocker arm and bell crank linkages and combined mechanisms.
06.04 Describe the principle and operation of four-bar mechanisms (crank, rocker and double rocker).
06.05 Describe the principle and operation of drag link and intermediate mechanisms.
06.06 Describe the principle and operation of four-bar variations.
06.07 Describe the principle and operation of cam mechanisms.

06.08 Describe the principle and operation of pivoted follower mechanisms.
06.09 Describe the principle and operation of toggle, quick return and ratchet mechanisms.
06.10 Describe the principle and operation of geneva mechanisms.

07.0 DEMONSTRATE PROFICIENCY IN TRANSDUCERS AND INSTRUMENTATION
The student will be able to:

07.01 Practice proper safety techniques.
07.02 Describe characteristics associated with transducers and instrumentation.
07.03 Describe the principle and operations of various types of transducers (eg. thermal, shock/vibration, acceleration, positional, pressure, flow, optical, gas and humidity).
07.04 Demonstrate the use of various transducers (eg. thermal, shock/vibration, acceleration, positional, pressure, flow, optical, gas and humidity).
07.05 Troubleshoot and repair transducers.
07.06 Describe transducer control and measurement circuits.
07.07 Demonstrate the use of control and measurement circuits.
07.08 Troubleshoot and repair control and measurement circuits.

08.0 DEMONSTRATE PROFICIENCY IN INDUSTRIAL MATERIALS
The student will be able to:

08.01 Practice proper safety techniques.
08.02 Describe the mechanical properties, tensile strength, modules of elasticity and hardness of materials.
08.03 Describe the effects of heat treating and aging on the properties of materials (Rockwell, Brinell, tensile testing).
08.04 Describe the effects of corrosion.
08.05 Describe the advantages of surface treatment of metals.
08.06 Describe the properties of plastic materials.

09.0 DEMONSTRATE PROFICIENCY IN AUTOMATIC CONTROLS AND ROBOTICS
The student will be able to:

09.01 Practice proper safety techniques.
09.02 Describe characteristics associated with automatic controls and robotics.
09.03 Describe the principle and operation of programmable logic controllers.
09.04 Demonstrate the use of programmable logic controllers.
09.05 Troubleshoot and repair programmable logic controllers.
09.06 Develop programs for programmable logic controllers.
09.07 Demonstrate the use of a program for programmable logic controllers.
09.08 Troubleshoot and repair a program for programmable logic controllers.
09.09 Describe the operation of robotic work cells.
09.10 Demonstrate the operation of robotic work cells.
09.11 Troubleshoot and repair robotic work cells.

01.0 DEMONSTRATE PROFICIENCY IN PRINCIPLES OF LIGHT

The student will be able to:

- **01.01 Practice proper safety techniques.**
- **01.02 Describe the characteristics of light sources.**
- **01.03 Describe radiometric and photometric quantities in the measurement of light using light meters and related equipment.**
- **01.04 Describe the properties of light.**
- **01.05 Demonstrate the properties of light.**
- **01.06 Describe the parts of the eye and their functions.**
- **01.07 Describe maximum permissible exposure (MPE).**

02.0 DEMONSTRATE PROFICIENCY IN OPTICAL SYSTEMS

The student will be able to:

- **02.01 Practice proper safety techniques.**
- **02.02 Describe the characteristics and properties of optical materials.**
- **02.03 Describe the eye as an optical system.**
- **02.04 Describe the use of optical components. (eg. lenses, beam splitters)**
- **02.05 Describe the principles and operation of optical systems. (eg. ray tracing, refraction)**
- **02.06 Demonstrate the use of optical systems. (eg. convergence, focusing, divergence)**
- **02.07 Troubleshoot optical systems.**

03.0 DEMONSTRATE PROFICIENCY IN LASERS

The student will be able to:

- **03.01 Practice proper safety techniques.**
- **03.02 Describe the principles of laser operations. (eg. population inversion, coherence)**
- **03.03 Describe laser classifications.**
- **03.04 Describe the principles and operation of powering and pumping lasers.**
- **03.05 Describe temporal characteristics.**
- **03.06 Describe spatial characteristics.**

04.0 DEMONSTRATE PROFICIENCY IN LASER ENERGY APPLICATIONS

The student will be able to:

- **04.01 Practice proper safety techniques.**
- **04.02 Describe the principle and operation of an ion laser.**
- **04.03 Demonstrate the operation of various ion lasers.**
- **04.04 Troubleshoot ion lasers.**
- **04.05 Describe the principle and operation of solid lasers.**
- **04.06 Demonstrate the operation of solid lasers.**
- **04.07 Troubleshoot and repair solid lasers.**
- **04.08 Describe the principle and operation of semiconductor lasers.**

04.09 Demonstrate the operation of semiconductor lasers.
04.10 Troubleshoot and repair semiconductor lasers.

04.11 Describe the principle and operation of dye lasers.
04.12 Demonstrate the operation of dye lasers.
04.13 Troubleshoot and repair dye lasers.
04.14 Demonstrate CW and pulsed operation.

05.0 PERFORM PROFICIENCY IN LASER APPLICATIONS

The student will be able to:

05.01 Practice proper safety techniques.
05.02 Describe the principle and operation of lasers in welding, cutting and drilling.
05.03 Demonstrate the use of lasers in welding, cutting and drilling.
05.04 Describe the principle and operation of lasers in data recordings and manipulating.
05.05 Demonstrate the use of lasers in data recording and manipulating.
05.06 Describe the principle and operation of lasers in environmental testing and monitoring.
05.07 Demonstrate the use of lasers in environmental testing and monitoring.
05.08 Describe the principle and operation of lasers in nondestructive testing.
05.09 Demonstrate the use of lasers in nondestructive testing.
05.10 Describe the principle and operation of lasers in range finding, alignment and angle testing.
05.11 Demonstrate the use of lasers in range finding, alignment and angle testing.
05.12 Describe the principle and operation of a laser in a communication system.
05.13 Demonstrate the use of a laser communication system.
05.14 Troubleshoot and repair a laser communication system.
05.15 Describe the principle and operation of fiber optics in laser systems.
05.16 Describe the principle and operation of using lasers in medicine.
05.17 Describe the principle and operation of using lasers in holography/interferometry.

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